Discussion

The USPTO rejected Claims 1 - 3, 7 - 16, 17 - 19, 21 - 23, 28 - 31 and 35 under 35 U.S.C. § 103 as being unpatentable over Robins, U.S. Patent No. 3,409,579 ("Robins") and further in view of "Translation from Roempp's Chemie Lexikon (10th Edition)" ("Roempp"). In addition, the USPTO rejected Claims 4, 5, 20, 24 - 26 and 32 - 34 under 35 U.S.C. §103 as being unpatentable over Robins and Roempp, as applied to the above-referenced claims and further in view of El-Demallawy, et al., (U.S. Patent Application 2003/0183364) ("El-Demallawy"). Finally, the USPTO rejected Claims 6 and 27 under 35 U.S.C. §103 as being unpatentable over Robins and Roempp as applied to the above-referenced claims and further in view of Miki, U.S. Patent No. 6,372,032 ("Miki").

Analysis

The Invention

The Applicants have discovered a new process for the production of shaped bodies, particularly cores, molds and feeders for use in foundry practice. In the method according to the invention, a phenolic resin in solid form

is blended with a polyisocyanate and a refractory material to produce compositions used to be formed into shaped bodies. The shaped body is then heated to a temperature above the melting point of the phenolic resin. The phenolic resin then liquefies and reacts with the polyisocyanate to form a polyurethane which acts as a binder between particles of the refractory material of the shaped body as part of the process to form cores, molds and feeders for foundry technology.

Robins in view of "Translation from Roempp's Chemie Lexikon."

Robins teaches a known process for the production of foundry boundary materials, that has been known for years. In fact, the Applicants have disclosed in a comparative example a process similar to that of Robins for the preparation of a foundry material. (See Example 1.1.1, the Cold-Box Process.) (Page 19, line 36 - page 20, line 21.) In the Robins process, a foundry composition is prepared comprising blending a phenolic resin, which has been dissolved in a non-aqueous system, with sufficient polyisocyanate to cross-link the phenolic resin. The composition is then cured with a tertary amine. (See Col. 3,

lines 3 - 7.) Robins teaches that although the prior art teaches heating the phenolic resin, Robins discovered the use of "binder compositions…which cure at room temperature." Col. 3, line 15. This process is disclosed at various locations throughout Robins.

Further, Robins requires the phenolic resin to be dissolved in an organic solvent. For example, at Col. 3, lines 48 - 55, Robins teaches that the phenolic "resin component comprising an organic solvent solution of a non-aqueous phenolic resin, the said hardener component comprising a liquid polyisocyanate having at least two isocyanate groups per molecule." Further, at col. 4, lines 1 - 2, Robins teaches that "any phenolic resin which is substantially free of water and is soluble in an organic solvent can be employed." At Col. 4, lines 58 - 61, Robins teaches that "[s]olubility in organic solvent is desirable to achieve the uniform distribution of the binder on the aggregate." At Col. 4, lines 73 - 75, Robins further advises that "[m]any resole resins, are difficultly soluble in organic solvents and thus, do not permit a uniform coating of the aggregate particles." At Col. 5, lines 46 - 48, Robins further advises that "the phenolic resin component of the binder composition is, as indicated above, generally

employed as a solution in an organic solvent." Further, each of the examples discloses the dissolution of the phenolic resin in an organic solvent. Finally, each claim of Robins states that the composition comprises "an organic solvent solution of a non-aqueous phenolic resin..." (Col. 11, lines 18 - 19.) Thus, Robins teaches the conventional, well known process for the production of a foundry binder which uses a phenolic resin dissolved in an organic solvent.

In contrast, the invention and all claims of the application claim a composition prepared by a process requiring the blending of "a phenolic resin in solid form." This process is specifically disclosed not only throughout the application, but in the examples as disclosed at page 21, lines 8 - 29.

When comparing the foundry binder material of the invention with those produced by processes similar to that of Robins, the advantages of the use of the solid form of the phenolic resin, as claimed by the Applicants, are clear. As can be seen from Table II on page 23, the product of example 1.1.1, produced by a process similar to that of Robins, the Cold-Box Process, has a strength of 650 N/cm^2. In contrast, the examples produced according to the invention, Examples 1.1.3.1 to 1.1.3.3 show strength in the range of

700 to 800 N/cm^2. Further, the samples produced according to the process of the invention show less deformation. As can be seen from Table III at page 23, the samples obtained by the method of the invention showed deformation of only 0.09 mm, with a load of 600g, whereas the sample of Example 1.1.1, produced by the the Cold-Box Process, which is similar to that disclosed by Robins, showed a much higher deformation of 1.3 mm.

As a further advantage, it has been shown in Example 1.4 beginning on page 23, that the samples obtained by the process of the invention have a much lower smoke evolution, when compared to samples obtained by the process that is similar to that of Robins, the Cold-Box Process. In addition, the samples produced by the methods of the invention barely produced perceptible odor after manufacturing, whereas the samples obtained by the Cold-Box Process, a process similar to that of Robins, showed a strong smell of solvent and amine. (See Table V on page 24.) Further, the shaped bodies produced by the process of the invention showed much better performance than bodies obtained by the Cold-Box Process, a process similar to that of Robins, as shown in Table VI. Thus, in comparison to the classic Cold-Box Process, samples obtained by the process of

the invention have the following advantages: 1) higher strength, 2) lower heat deformation, 3) lower smoke evolution during casting, 4) lower odor of the shaped bodies during storage, and 5) considerably less casting flaws.

In addition to Robins teaching that the phenolic resin component must be dissolved in an organic solvent prior to use, Robins further teaches that the binder composition is cured at room temperature instead of heating the composition above the melting point of the phenolic resin, as is required by Claim 1 of the application. In fact, Robins specifically teaches away from the concept of heating the phenolic resin. At Col. 3, lines 8 - 16. Robins concludes by stating "[a]ccording to the present invention, binder compositions are provided which cure at room temperature." Further references to the lack of curing at anything but room temperatures are provided at Col. 3, lines 17 - 25 and 61 - 65. While the USPTO has asserted that it would have been obvious to a person skilled in the art to heat the composition at increased temperatures, this process is clearly in opposition to the process specifically and unambiguously taught by Robins.

Accordingly, not only is the process of the invention fundamentally different from that of the prior art,

particularly Robins, there are significant advantages and improvements in the products produced by the process of the invention.

Roempp does not add to the teaching of Robins. Roempp discloses two methods for curing phenolic resins. On page 2, last paragraph, the curing of novolaks is described. For curing, hardening agents, preferably formaldehyde or compounds producing formaldehyde, are added to the novolaks and the novolaks are cured by cross-linking at increased temperatures. As described at page 3, second para., resoles are self-curing by the reactive methanol group. Roempp therefore merely describes curing of a phenolic resin, but not a reaction between phenolic resin and an polyisocyanate with the formation of polyurethane. In the process of Claim 1, a hydroxy group of the phenolic resin reacts with the isocyanate group of the polyisocyanate resulting in formation of an urethane bond. No such urethane bond is formed in the curing of phenolic resins as disclosed by Roempp. Accordingly, the process of Roempp is also fundamentally different from that of the invention.

The USPTO asserts that

> "Roempp discloses that novolak phenolic resins cured faster by cross linking at increased temperatures of 140-180°C (page 4), which is above

> the melting point of the phenolic resin … Therefore, it would have been obvious to one of ordinary skill to raise the temperature of the shaped body to above the melting point of the phenolic resin in order to cure the composition."

The Applicants assert that this combination of teachings is not permitted under KSR Int'l Co. v. Teleflex Inc., 127 S.Ct. 1727, 1741 (2007). Robins specifically teaches that the curing of the binder composition occurs at room temperature. (Col. 3, lines 14-16.) In fact, Robins teaches that curing at room temperature is highly advantageous over the prior art processes that require heating. (Col. 3, lines 8-16.) Thus, Robins teaches away from raising the temperature of the shaped body to above the melting point of the phenolic resin. This teaching is clearly distinct from the asserted teaching of Roempp.

In Ex parte Whelan, 89 U.S.P.Q. 1078, 1084 (2008), a similar obviousness rejection was made by the Examiner. The Board rejected the position taken by Examiner and asserted,

> The *KSR* Court noted that obviousness cannot be proven merely by showing that the elements of the claimed device were known in the prior art; it must be shown that those of ordinary skill in the art would have had some "apparent reason to combine the known elements in the fashion claimed." *Id.* at 1741.

The USPTO has not explained the reason why a person skilled in the art who is taught by Robins to cure the

shaped body at room temperature would have modified that approach to heat the shaped body to a temperature above the melting point of the phenolic resin, as required by all claims of the Application. Ex parte Whalen specifically advises that a mere assertion that the known process could have been modified by routine experimentation or solely on the expectation of success is not adequate to prove obviousness. Rather, there must be some "reason to combine" the teachings of Robins and Roempp. No such reason exists, especially as Robins specifically teaches away from said combination. Accordingly, the combination of Robins and Roempp asserted by the USPTO is not appropriate and not permitted by *KSR*.

Rejection based on Robins in view of Roempp and further in view of El-Demallawy, et al.

The distinctions of Robins and Roempp are discussed above and need not be repeated. Notwithstanding, it is clear that the process of the invention is entirely different from what is disclosed in Robins or Roempp alone or in combination.

El-Demallawy, et al. disclose a process for forming a mold or core for casting molten metal for machining to a

desired shaped, wherein the shear strength of the refractory particles are less than the shear strength of the bonds between the particles. According to paragraph 0022, the body of bonded refractory particulate material may be produced by mixing together the refractory material and the binder, forming the mixture into the desired pre-formed shape and allowing the binder to cure. Exemplary binder systems that are described are phenolic urethane binders which are cured by means of a polyisocyanate component mixed with a phenolic resin component or with a liquid or gaseous tertary amine catalyst. Accordingly, El-Demallawy, et al. therefore describe use of the classic, "Cold-Box Process" that is described in Example 1.1.1 of the application or the "no-bake-process" with use of a liquid tertary amine catalyst. Both processes fail to use a phenolic resin in solid form. Further both processes are performed at room temperature, i.e. below the melting point of the phenolic resin. Therefore, El-Demallawy, et al. do not add to the teaching of Robins and/or Roempp to disclose the invention, as disclosed and claimed by the Applicants.

Rejection based on Robins and Roempp and further in view of Miki

The Applicants repeat their discussion of Robins and Roempp and assert that neither discloses the invention as claimed alone or in combination.

Miki merely discloses a foundry exothermic assembly formed by mixing hollow glass microspheres in an inorganic or organic binder with matrix forming constituents, and shaping and curing this mixture. Miki does not describe the use of a phenolic resin in solid form. Further, Miki does not disclose curing of a shaped body by raising the temperature of the shaped body to above the melting point of phenolic resins. Thus, the subject matter of Claim 1 is also not disclosed by Miki alone or in combination with Robins and/or Roempp.

CONCLUSION

The Applicants respectfully assert that none of the references teach the invention, as claimed and request the issuance of a Notice of Allowance. If there are any questions concerning this Amendment, please contact Applicants' counsel.

Respectfully Submitted,

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